REMARKS

Reconsideration and withdrawal of the rejections set forth in the above-mentioned Office Action in view of the foregoing amendments and the following remarks are respectfully requested.

Claims 1-13 are now pending in this application, with Claim 1 being the sole independent claim. Claims 1, 3, 5-7, and 9 have been amended and Claims 11-13 are newly-presented herein.

Claims 1-6 and 9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over European Patent Application No. 1 380 423 (Kubota et al. '423) in view of Japanese Laid-Open Patent Application No. 2001-179990 (Imamura). Claims 1-9 were rejected under 35 U.S.C. § 103(a) as being unpatentable over European Patent Application No. 1 380 425 (Kubota et al. '425) in view of Imamura. Claim 10 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kubota et al. '423 in view of Imamura and further in view of European Patent Application No. 1 013 648 (Ito et al.) or Swedish Doc. No. 2002-545791 (Andersson et al). Claim 10 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Kubota et al. '425 in view of Imamura and further in view of Ito et al. or Andersson et al. Claim 9 was rejected under 35 U.S.C. § 102 as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over Imamura. These rejections are respectfully traversed.

The present invention as recited in independent claim 1 relates to a method for manufacturing a liquid discharge head wherein, inter alia, a layer of a composition is heated at a temperature of 120°C to 150°C and a discharge port is formed through a photolithographic process comprising exposing and developing a coating layer.

With the above configuration, the present invention can achieve the following results, as described in page 11, line 19 to page 12, line 3 of the original specification:

> A copolymer of methacrylate ester and methacrylic anhydride is employed as the solid layer formation resin that directly contacts the discharge port formation member to aggressively obtain the compatibility between the solid layer (removable resin layer) and the solvent contained in a coating liquid that is used to form a coated layer that is made of the discharge port formation material. And the obtained compatible layer has a property that it can be completely dissolved in a development liquid used to develop the discharge port formation material.

Accordingly, the occurrence of scum can be prevented at the interface between the removable resin and the nozzle formation material used for forming ink discharge ports.

Kubota et al. '423 discloses that materials of a cross-linked positive-working photosensitive resin formed on a substrate include methyl methacrylate, methacrylic acid and methacrylic anhydride. More specifically, P (MMA-MAA-MAN) being of heat-bridge (or thermal cross-linkage) positive-working resist is applied on the substrate using spin coating and then heated at a temperature of 120°C to 220°C, preferably 160°C to 200°C for thermal crosslinkage.

Compared to Kubota et al. '423, the present invention, as recited in independent claim 1, is similar in that the copolymer of methacrylic anhydride and methacrylate easter is employed as a layer used for forming a flow path, but is different in that the copolymer of methacrylic anhydride and methacrylate ester is heated at a temperature of 120°C to 150°C. In Kubota et al. '423 the copolymer of methacrylic anhydride and methacrylate ester is heated at a preferred temperature of 160°C to 200°C.

With a heating temperature of 120°C to 150°C, a solid layer can be formed with the heat-bridge restrained. When a liquid solution is applied on the solid layer to form a coating

layer, the phase solution between the solution and the solid layer is advanced positively (i.e., the phase solution is not readily advanced if the cross-linkage is hard). Further, a generated layer of the phase solution can be dissolved effectively to a liquid developer for developing a discharge port forming material. Accordingly, this can prevent the occurrence of scum and provide a liquid discharge head having high discharge performance.

In Kubota et al. '423 the copolymer of methacrylic anhydride and methacrylate ester is heated at a temperature of 120°C to 220°C, preferably 160°C to 200°C. In this case, it is not clear how much scum is restrained.

The upper-limit (150°C) of heating the composition at a temperature of 120°C to 150°C, as in the present invention recited in independent claim 1, is significant as can be seen in the attached documents (Attachment ① and Attachment ②).

A resin of which a main component is methacrylate can be dissolved in diglyme (boiling point=162°C) or cyclohexanone (boiling point=156°C) as solvent and applied. In an embodiment of the present invention, diglyme is employed. In heating, it is considered as important that a heated temperature is not higher than a boiling point of the solvent.

In Attachment ①, the upper graph shows a result (total ion chromatogram) regarding PMMA membrane only applied and the lower graph shows a result (total ion chromatogram) regarding PMMA membrane baked at 200°C.

From Attachment ①, it is seen that a solvent peak is detected in the membrane not baked, but the solvent (cyclohexanone (boiling point=156°C)) in the membrane has disappeared by baking at 200°C.

Since the heat-bridge of methacrylic anhydride and methacrylate ester of the present invention is built up by hydro-extraction and condensation, it is rapidly progressed by heating

and poor-solvation. So, if a heating temperature is set to 150°C (boiling point of a typical solvent), sufficient solvent can be provided and thus progress of heat-bridge can be restrained. This can correspond to "Measure 2" described in the specification (pages 11 and 12).

Attachment ② indicates examples where the present invention has been implemented (images at the left side) and not implemented (image at the right side), in which Japanese term "吐出口" indicates a discharge port, "流路" indicates a flow path, "流路壁" indicates a wall the flow path, "スカムなし" indicates no scum, and "スカム発生" indicates occurrence of a scum.

The lower-limit (120°C) of heating the composition at a temperature of 120°C to 150°C, as in the present invention as recited in independent claim 1, is significant, as indicated in the following documents. The documents show that a glass transition point of the resin whose main component is methacrylate is 105°C.

i) ISBN 4-88231-525-4 (Development & Application of Nanoimprint, K.K. CMC Publication) (URL: http://www.sgsc.co.jp/products/hikari_s.pdf)

ii) Japanese Patent Laid-open 2001-324626 Paragraph [0019] (This document indicates that the glass transition point of PMMA-system resin is 110°C.)

Further, Kubota et al. '425, Imamura, Ito et al. and Andersson et al. fail to remedy the above-noted deficiencies of Kubota et al. '423. Kubota et al. '425, Imamura, Ito et al. and Andersson et al. fail to teach or suggest providing a layer of the composition containing the copolymer of methacrylic anhydride and methacrylate ester on the substrate and heating the layer of the composition at a temperature of 120°C to 150°C.

Thus, Claim 1 is patentable over the citations of record. Reconsideration and withdrawal of the § 103 rejections are respectfully requested.

For the foregoing reasons, Applicants respectfully submit that the present invention is patentably defined by independent Claim 1. Dependent Claims 2-13 are also allowable, in their own right, for defining features of the present invention in addition to those recited in independent Claim 1.

For example, in dependent claim 7, after forming a first positive type photosensitive material layer (which will be part of the solid layer), a second positive type photosensitive material layer of the composition containing the copolymer of methacrylic anhydride and methacrylate ester is formed. In this instance, since a baking temperature (120°C to 150°C) is relatively low, a lower layer (i.e., a first positive type photosensitive material layer) can be prevented from damage.

Also, in dependent claim 11, the coating layer is applied on the solid layer using a liquid mixture of methyl isobutyl ketone and xylene as a solvent, therefore the phase solution can be more appropriately advanced. In the photolithographic process, a part of the coating layer corresponding to the discharge port is removed using a liquid mixture of methyl isobutyl ketone and xylene as a liquid developer, therefore the layer of the phase solution completely dissolves in the solid developer.

Individual consideration of the dependent claims is requested.

This Amendment After Final Rejection is an earnest attempt to advance prosecution and reduce the number of issues, and is believed to clearly place this application in condition for allowance. This Amendment was not earlier presented because Applicants earnestly believed that the prior Amendment placed the subject application in condition for allowance. Accordingly, entry of this Amendment under 37 CFR 1.116 is respectfully requested.

Applicants submit that the present application is in condition for allowance. Favorable reconsideration, withdrawal of the rejections set forth in the above-noted Office Action, and an early Notice of Allowability are requested.

Applicants' undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,

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別紙

①熱架橋型：P(MMA-MAA)膜の分析結果

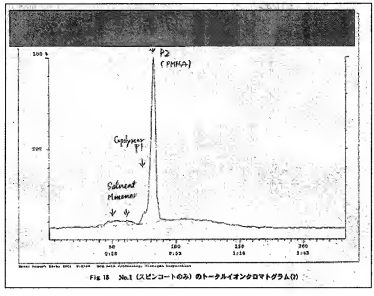


Fig. 18　No.1（スピンコートのみ）のトータルイオンクロマトグラム(I)

塗布のみＰＭＭＡ膜

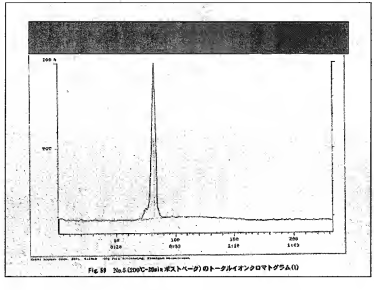


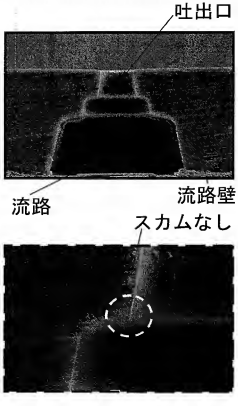
Fig. 19　No.5（200℃-20minポストベーク）のトータルイオンクロマトグラム(I)

２００℃ベークしたＰＭＭＡ膜

ベークを行っていないものには膜中の溶媒（シクロヘキサノン（沸点１５６℃））ピークが見られるが、２００℃ベークにより、膜中の溶媒が、消失していることが分かる。

②

本発明実施



本発明を実施しない場合